United States Patent [19]

Krieg

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[45] **Jan. 29, 1974**

[54] **METAL FORMING TOOL**

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[52] **U.S. Cl.** **90/40,** 90/31, 90/44, 83/3

[51] **Int. Cl.** **B23d 3/04**

[58] **Field of Search** 90/38, 31, 24, 39, 40, 43, 90/44; 83/3

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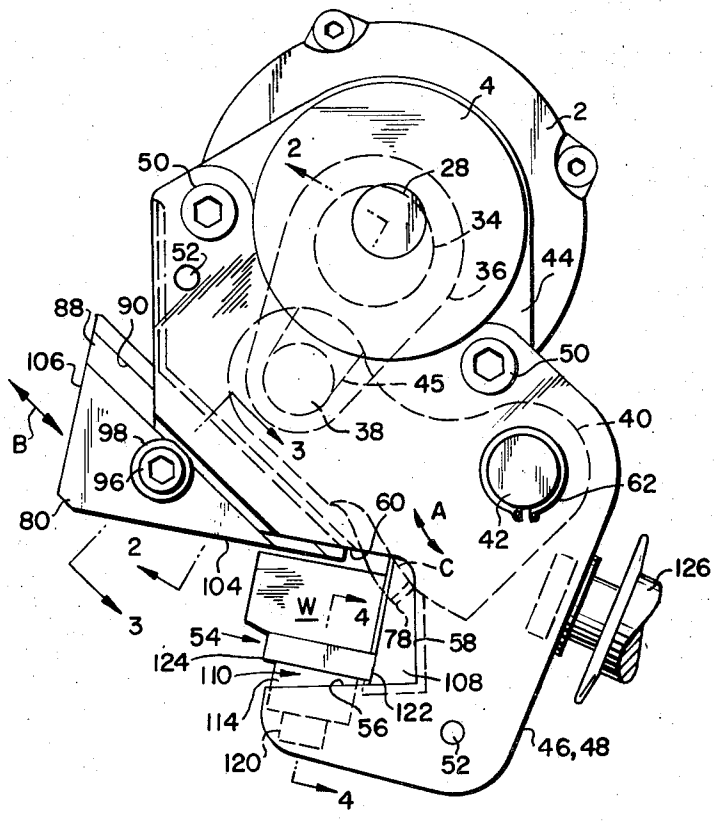
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[57] **ABSTRACT**

A tool for preparing beveled edges on metal workpieces having workpiece holding means and a cutting element. The cutting element being mounted in a carrier pivotally movable in an arc to form a curved bevel in the workpiece.

15 Claims, 9 Drawing Figures



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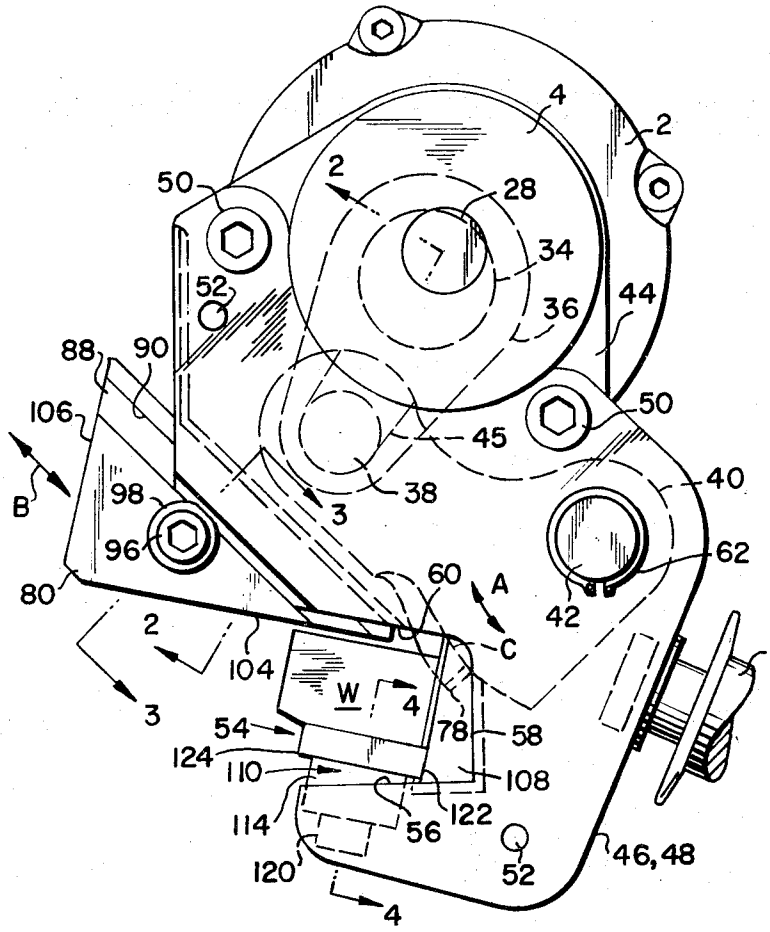


FIG.1

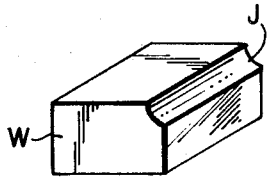
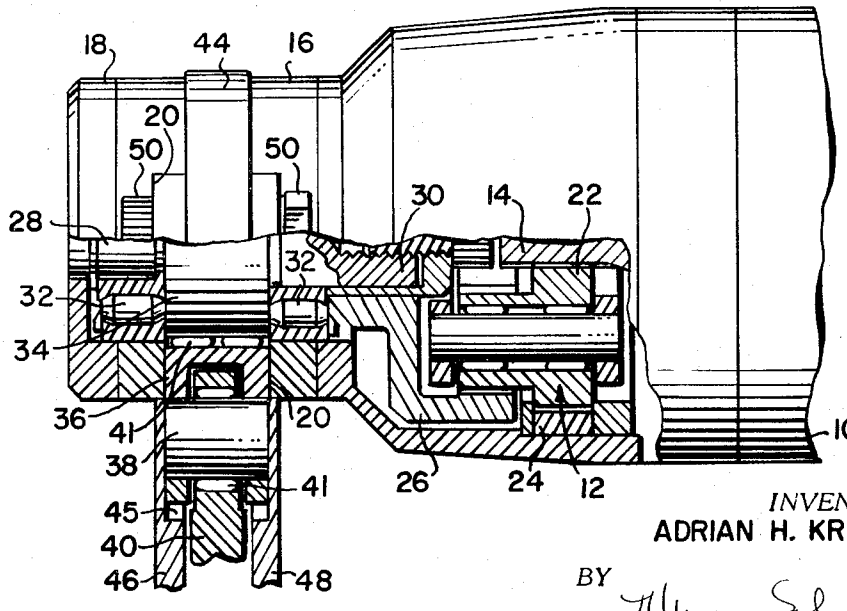


FIG.1a

FIG.2



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FIG.3

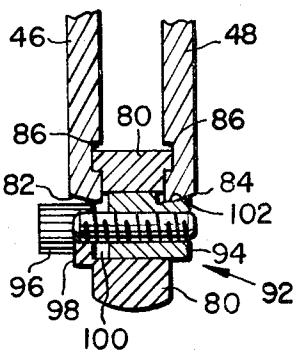


FIG.4

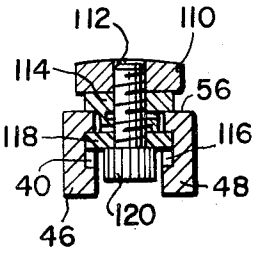
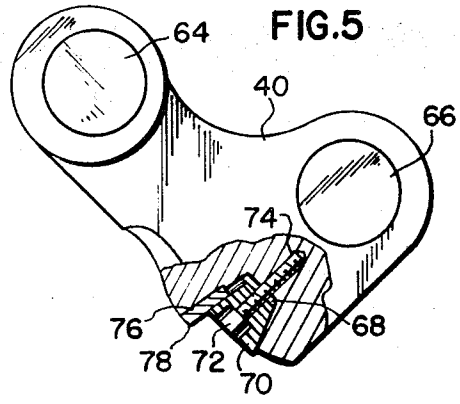


FIG.5



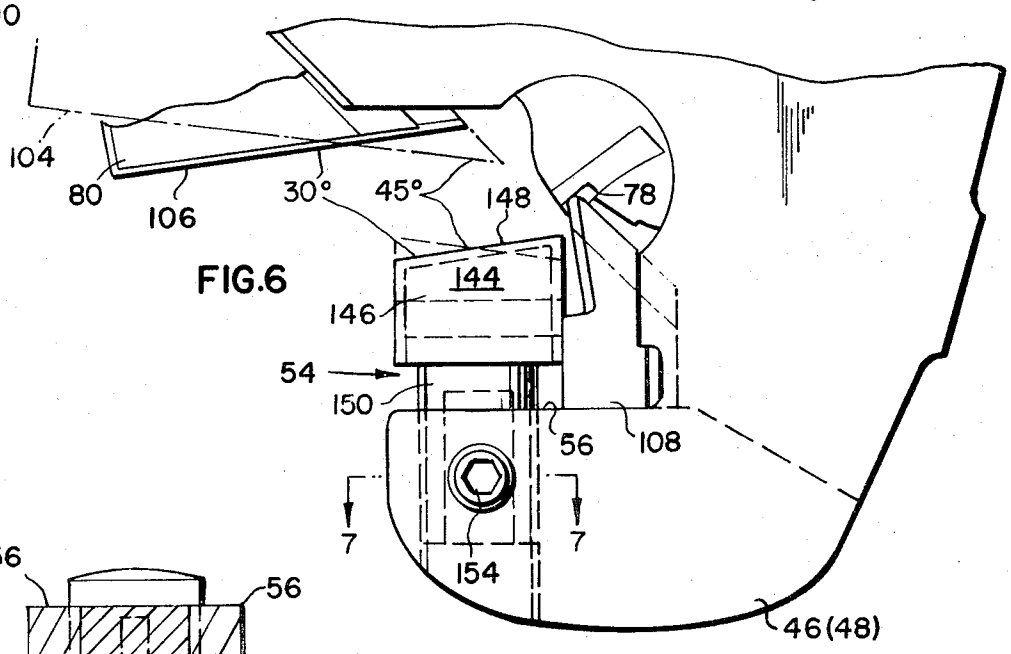


FIG.6

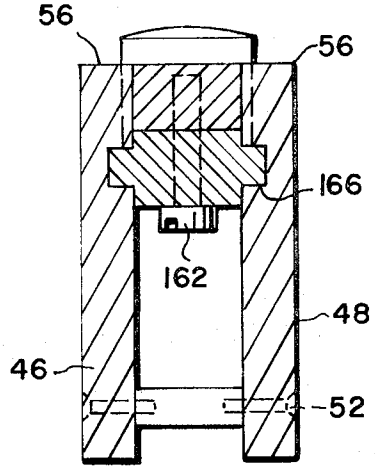


FIG.8

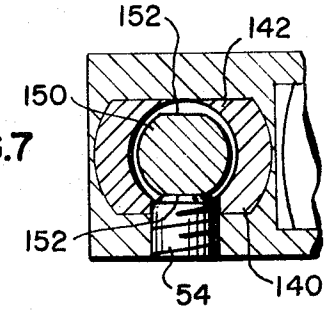


FIG.7

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METAL FORMING TOOL

BACKGROUND OF THE INVENTION

The present invention relates to metal forming tools and in particular to a portable tool for preparing the edges of metal work-pieces prior to their being welded together.

The edge of the metal pieces which are to be joined by welding are provided with a bevel which insures the proper abutment of the pieces and enables the weld to obtain a sufficiently good penetration to insure proper adhesion. Depending upon the welding procedure which is employed, the joined shapes between the metal workpieces are bevelled in different forms, that is, predetermined amounts of material are removed from the edges of the metal workpiece to form dovetail or other interengaging edges which insure that the weld material flows properly and joins the parts. The present invention concerns a tool for making a J-bevel.

Portable electrical forming tools carrying out a bevelling function are known. The conventional tools consists of an electric motor, a gear case and a guide bracket which is propelled over the material to be bevelled. A cutting element is reciprocated along a straight line by the electric motor which cuts the material by punching or tearing at the workpiece as the cutter is being reciprocated. The conventional device is alsO provided with means for guiding the workpiece, a rest plate on which the work is held and which also provides a workstop to absorb the forces of the reciprocating cutting element and a moveable strip to provide the proper gap opening made by the cutting element. Depending upon the measurements of the workpiece and the desired bevel, single ones of these auxiliary means are exchangeable so that specifically designed machine parts may be used to obtain the proper bevel. In order to accomodate workpieces of different sizes the rest pieces or work-stop portion was sometimes mounted on a pivotable arm or bracket.

The conventional tool has serious drawbacks arising from the straight line reciprocation of the cutting element. First the entire force produced by the load on the cutting element must be absorbed by the tool resulting in considerable energy loss. Considerable friction and wear is developed between the cutting element and its guidance structure. Slag, dirt, rust, etc. is introduced into the tools, significantly reducing the life of the machine.

Furthermore, the cutting edge of the cutter element must be frequently sharpened or replaced. In order to do this, the entire guide bracket must be removed and the element extracted from its holder. On replacement of the element, it must be readjusted due to the fact that a sharpened element is shorter or a new element is longer.

Most important, however, is the fact that the prior art devices can not form a J-bevel where a portion of the edge is curved or concave, because the reciprocating straight line action of the cutting element permits only straight cuts as in the conventional V, X, or K shapes.

It is an object of the present invention to provide a portable beveling tool overcoming the defect of the prior art.

It is a particular object of the present invention to provide a bevelling tool capable of making a J-bevel without the need for subsequent machining.

It is another object of the present invention to provide a bevelling tool having a longer life and requiring less repair and resharpening.

It is still another object of the present invention to provide a bevelling tool which is easier to use, simpler in construction and more economical.

These objects, as well as others together with numerous advantages will be apparent from the following description.

SUMMARY OF THE INVENTION

According to the present invention a tool for bevelling an edge of an elongated metal workpiece is provided comprising a head, a stirrup, depending from the head and a cutting member. The stirrup defines an opening for receiving the workpiece and means are provided for interconnecting the cutting element with a motor to swing the cutting element in an arcuate path through a corner of the opening to cut a curved groove or bevel in the workpiece.

Preferably, the cutting member is pivoted to the stirrup so as to be fulcrumed about a point remote from the connection thus providing the arcuate path. The cutting member includes a replacable blade element, which may also be formed with more than one cutting edge. The blade edges can be sequentially presented for use prior to the replacement of the entire blade.

Also, the present invention provides a bed plate for supporting the workpiece which is adjustable both vertically and horizontally within the opening whereby the workpiece may be held for action by the cutting member at a predefined and fixed position.

A guide is also provided for limiting the upper edge of the opening and for positioning the workpiece. This guide is adjustable so that it may present its edge at one or more angles to the workpiece. It may also be replacable.

Full details of the present invention will be seen in the attached drawings and from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. **1** is an end view of a bevelling machine embodying the present invention,

FIG. **1***a* is a view of a workpiece bevelled according to the present invention,

FIG. **2** is a side view partially in section of the machine shown in FIG. **1**,

FIG. **3** is a sectional view taken along lines **3—3** of FIG. **1**,

FIG. **4** is a sectional view along lines **4—4** of FIG. **1**,

FIG. **5** is a view of the cutting element carrier seen in dotted lines in FIG. **1**,

FIG. **6** is an enlarged view of FIG. **1** showing modified bed plate portion,

FIG. **7** is in section along lines **7—7** of FIG. **6**, and

FIG. **8** is an enlarged view of an adjustable mounting for the bed plate.

DESCRIPTION OF THE INVENTION

Turning now to FIGS. **1** and **2** the present invention is embodied in a tool capable of being manually carried and manipulated by a single operator. The tool comprises a housing **10** in which a planetary gear system **12** is located and driven by a pinion **14** of (not shown) conventional rotary motor located in the remaining

portion of the housing. The motive means is preferably an electric motor including control systems, both of which are conventional in hand tools and portable machine tools. Extending axially from the opposite end of the housing **10** is a cylindrical cowling **16** capped at its end by a cover member **18.** The cowling has an arcuate opening **20** along a portion of its lower periphery.

The motor pinion **14** meshes with the exterior planetary gear **22,** of the planetary system **12** which includes a fixed gear **24** and a rotating inner gear **26.** A shaft **28** is keyed at **30** or otherwise integrally fixed to the gear **26** and extends coaxially within the cowling **16.** The shaft **28** is journaled within a pair of spaced bearings **32** supported by the cowling. The adaption of a planetary gear system with a rotary motor provides a high torque and power input in a minimum of space. Further, such a system may be easily controlled as to speed. However, a rotary drive, power and transmission system is not essential and may be replaced with other suitable motive means.

Fixed eccentrically of its center to the shaft **28** is a circular sleeve **34** to the outer perimeter of which a connecting arm **36** is fixed. The arm **36** extends generally downwardly out of the cowling opening **20** and has fixed to its outer end a pivot pin **38** about which a cutting element carrier **40** is pivotably fulcrumed. Roller bearings **45** are interposed about the shaft **28** and the pivot pin **38.** The cutting element **40** is eccentric in shape, as seen later and is pivotally movable about a second fulcrum pin **42** offset from the pin **38.**

Surrounding the cowling **16** is an integral yoke **44** to which a pair of generally C shaped or stirrup shaped plates **46** and **48** are secured by bolts **50.** The stirrup plates **46** and **48** are spaced from each other by a distance equal at least to the width of the opening **20** through which the arm **36** passes thus, permitting the cutter element carrier **40** to freely move therebetween. The C shaped stirrup plates **46** and **48** are joined about their peripheries by one or more bolts **52** provided with appropriate interior spacers. The stirrup plates are arranged so that its bight or opening, generally defined by the numeral **54,** lies beneath the carrier **40.** The bight **54** is defined by a horizontal lower edge **56,** a vertical back edge **58** and a horizontal upper edge **60,** formed in each of the plates **46** and **48.** The second fulcrum pin **42** for the cutting element carrier **40** is located at the upper portion of the stirrup plates **46** and **48** and is removably retained transversely thereto in bearing seats by a C-clamp **62** or similar removable fastening means.

As seen in FIG. **5,** the carrier **40** is a generally triangular eccentric member provided with a hub **64** at one of its base angles which is adapted to pivot about the first pivot pin **38,** and a second hub **66** at the other of its base angles adapted to pivot about the second pivot pin **42.** At its apex, however, the carrier **40** is cut with a transverse groove **68** in which a wedge **70** is fit. A screw **72** extends through the wedge **70** and is secured with a threaded bore **74** in the carrier. This arrangement is adapted to hold a cutting element **76** in the forming of a plate of hardened steel or carbide whose leading edge **78** produces the bevel cut. This arrangement is simple and easily manipulated without disassembly of the machine to adjust the position of edge **76** with regard to a workpiece located within the bight **54.** The cutting element **78** is also provided with a sharp edge about each of its peripheral sides, so that when one edge is worn it may be simply rotated to provide a new sharp edge for use before the entire blade is discarded and replaced.

As seen in FIG. **1** the carrier **40** is pivoted to swing about the fixed pivot axis **42** on reciprocation of the arm **36** and at the same time about the pivot pin **38.** This enables the carrier **40** to take an arcuate path of movement within a plane parallel to the plane of the stirrup described, generally and schematically, by the arrow A. By dimensioning the carrier **40,** and the spacing of the pivot pins **38** and **42** appropriately, the cutter element **78** may be made to pass through a corner C of the bight **54** in such an arcuate path, that a workpiece W, placed transversely within the bight **54,** will be engaged and will be honed or cut with a corresponding curved bevel, such as the desired J-bevel, as seen in FIG. **1***a*.

A guide member in the form of a triangular plate **80** is located between the leading edges **82, 84,** (FIG. **3**) of the stirrup plates **46, 48.** The leading edges **82, 84** of the stirrup plates are straight edges angled downwardly toward the bight **54.** The edges are bevelled with a flat flare outwardly along their entire surface as seen in FIG. **3.** Grooves **86** are formed on the inner surface of the plates **46, 48** parallel to the straight edges **82** and **84** respectively. The triangular guide **80** is also provided with a groove or slot **88** having a straight lip **90** which fits correspondingly in the grooves **86** so that the triangular guide **80** may be made to slide with respect to the stirrup plates **46, 48** toward and away from the bight **54** along the path indicated by the arrow B. The triangular guide **80** is held firmly in a desired position by a manipulatable securing mechanism **92** mounted on the guide as seen in FIG. **3,** comprising a wedge **94** transversely adjusted by a thumb screw **96** the head of which is spaced from the flat surface of the guide **80** by a washer **98.** The mechanism **92** is generally situated through a hole **180** bored transversely through the guide **80** a distance from the groove **88** so that the wedge **94** engages the outwardly bevelled edge of one of the stirrup plates **46, 48.** The wedge **94** may be conical or cubed and should, as seen in FIG. **1,** have an edge **102,** preferably flat, which engages the edge **82** or **84.**

The triangular configuration of the guide **80** and the arrangement of groovings in both it and the stirrup plates permit the guide to be reversed, so that either of its edges **104** or **106** (FIG. **1**) may be made to face the workpiece. Thus, the same guide **80** may be used with varying workpieces, eliminating the need for the user to stock numerous pieces of auxiliary equipment. As seen in the drawings, the guide **80** and the cutting element carrier **40,** because of their arrangement between the plates **46, 48,** are aligned in the same vertical plane. This arrangement and the dimensions of the device are such, however, that notwithstanding the depth at which the guide **80** is slid along the path of the arrow B, the carrier **40** is swung about its arcuate path A so that the cutting element **78** always clears the edge of the guide and contacts only the edge of the workpiece located in the bight **54.**

A depth stop or die **108** may be provided at one side of the stirrups **46, 48** to limit the extent of the bight **54** and thus enable the positioning of the workpiece W in it. The stop **108** may be adjustably screwed or otherwise fastened to one or both of the plates **46, 48,** preferably outside of them, so as not to interfere with the movement of the carrier **40** and the cutting element **78.**

The workpiece is adapted to rest on a bed plate **110** secured along the lower edges **56** of the stirrup plates along the bight **54.** One form of bed plate mounting arrangement is seen in FIG. **1** and FIG. **4.** The bed plate **110** is provided with a centrally threaded bore **112** and is backed by a T-shaped element **114,** the stem of which fits between plates **46** and **48.** The plates **46** and **48** are provided with grooves **116** running parallel to the edges **56** in which a washer **118** may be located. A thumb screw **120** extends through the washer **118** and the T-shaped element **114** into the threaded bore **112** of the bed plate **110.** Tightening of the thumb screw causes the bed plate to be drawm securely into a seated arrangement against the edges **56** of the plates **46, 48.** The bed plate **110** is adjustable toward and away from the depth stop **108** by sliding it in the groove **116,** although preferably it is positioned in use with its forward edge **122** abutting against the depth stop (FIG. **1**). This edge **122** is itself provided with a J-bevel in order to accommodate any slag or irregularities in the workpiece W. The opposite or rear edge **124** of the bed plate may be square. By reversal of the bed plate 180°, the square edge **124** may be used against the depth stop **108** to provide a square rest for the workpiece. Soft and hard materials may thus be used. By suitably sloping the edges **56,** or the stem **114** of the bed plate as seen in FIG. **1,** the adjustment of the bed plate with respect to the depth stop **108** also causes the bed plate **110** to rise or fall with respect to the upper edges **60** of the bight **54,** as the bed plate itself is shifted into or out of the bight by sliding it in the grooves **116.** This permits a limited degree of vertical adjustment of the workpiece with respect to the cutting element carrier **40.**

A handle **126** may be secured to the stirrup plates **46, 48** in conventional manner, or by a similar slot and wedge arrangement as secures the guide plate **80** or the bed plate **110** may be used to secure the handle.

The stirrup plates **46** and **48** may be reversed with respect to the motor housing so that the bight **54** will open to the right instead of the left, as shown in FIG. **1.** This is accomplished simply by removing bolts **50** and shifting the plates **46, 48** downwardly through a slot **45** so that the pivot pin **38** can be removed. The entire assembly may then be reversed and the pivot pin **38** replaced and the bolts **50** retightened.

In operation, the machine is carried to the elongated workpiece and is placed over it so that the workpiece rests on the bed plate **110.** The guide plate **80** is lowered to enable movement of the machine along the face of the workpiece but prevents skewing or canting of the machine during its cutting operation. The position of the depth stop **108** is adjusted to control the depth of the bevel to be cut and the machine is then actuated. The arcuate reciprocation of the carrier **40** causes the cutting element to hit the edge of the workpiece and gouge the bevel in its edge. As the machine is moved along the length of the workpiece W a continuous bevelled edge is obtained, as seen in FIG. **1***a*.

The motion of the cutting tool does not follow a straight line and its arcuate movement produces a concave bevel of the J-type. This has an added advantage in that the movement of the cutting element in the circular path does not tear or hammer at the material of the workpiece but shears and cuts the material. Thus, the workpiece is provided with the proper concavely curved or arched bevel required by the welding codes. Another advantage is obtained in that the present invention the lateral forces of cutting are more efficiently absorbed and friction is markedly reduced. The machine will have a considerably longer life.

The edges of the cutting element do not require the frequent sharpening required by the prior art devices. However, since the blade or cutting element **78** is rotatable, a new edge may be provided in a matter of seconds. Since the edges of the blade are symmetrical with respect to the element as a whole, it is not necessary to constantly readjust the machine when a new edge is presented as is necessary in prior art devices where blades are fully replaced. The cutting element **78** may be made of such size, that when all four of its edges have been used the element has been exhausted and may be thrown away. This reduces costs for resharpening and resetting. Thus, neither carrier **40,** bed plate **110** or depth stop **108** need be readjusted once cutting has begun even though the cutting edge is rotated. Still another advantage occurs from the present arrange in that the cutting element may be made of carbide or similar materials having long life. Because the element cuts, rather then impacts the material, such material may be used even though they normally have low resistance to impact shock.

The guide plate **80** may be adjusted to present different degrees of attack on the workpiece and may be reversed as previously described into different positions. Similarly, the bed plate **110** can also be adjusted to provide varying rest surfaces and different levels of support.

In the above mentioned embodiments a generally fixed, although partially adjustably fixed bed plate, is shown. It may however, be sometimes advantageous to provide bed plates which are not only adjustable with respect to the depth stop but are also vertically adjustable. In FIGS. **6** and **7** one such bed plate construction is shown. As seen in these Figures, the lower edges **56** of the stirrup plates **46, 48** within the bight **54** may be left flat and in a horizontal plane. Set securely between the plates **46, 48** below the bight is an oval bushing **140** having a circular bore **142.** Slidably mounted in the bore **142** is a base plate generally depicted by the numeral **144** comprising a head **146** having an upper flat surface **148** inclined with respect to the horizontal and a stem **150.** The stem **150** is generally circular and fits within the bore **142,** however, it is provided with a pair of opposed flat surfaces **152** running substantially its length. Extending transversely through the face of one stirrup plate **46** or **48** and the bushing **140** is a set screw member **154** which is adapted to abut in pressure relationship against the flat land surface **152** of the stem **150.** It will be observed that a small turn loosening the set screw **154** will permit the base plate to be raised vertical toward the cutting element **78** while a greater degree of loosening will permit the base plate to be swivelled in the bushing, so that the higher or lower edge of the flat face **148** may be presented toward the cutting element. By the latter adjustment the angle of the face **148** with the slidable guide **80** may be varied. By this arrangement both the height of the bevel and the angle of attack of the cutting element with respect to the workpiece may be varied. FIG. **6** shows the advantage obtained by having a reversible guide **80,** in the manner earlier described. The positions of leading edges **104** and **106** are seen in dotted and full lines respectively. With this only one depth stop or die member **108** is necessary. As seen by providing edge **106**

with a backwardly sloping bed plate an angle of attack of 30° may be obtained while reversing the two an angle of 45° may be obtained relative to the horizontal. Thus, more then one degree of bevel can be obtained with the same machine.

Still another form of adjustable bed plate is seen in FIG. **8.** The bed plate **160** is similar to that seen in FIG. **4,** however, the plate and T-shaped stem are integral with each other and the screw **162** is threadably secured to the stem and extends through the retaining washer **164** which fits within a groove **166** with no vertical play so that it acts as a back stop and retaining member. Thus, rotation of the screw will adjust the height of the bed plate while maintaining it fixedly secured to the stirrup plates **46, 48.** Numerous other adjustable mountings are obtainable.

It will thus be observed that the objects aforementioned are all obtained by the present invention and that a simple efficient bevelling machine is obtained to overcome the defects of the prior art. Various changes and modifications are permissable and will be obvious to those skilled in this art. It is therefore, intended that the present description be illustrative only and not limiting of the present invention.

I claim:

1. A tool for bevelling an edge of an elongated workpiece comprising a head, a stirrup depending from said head, an opening defined in said stirrup for receiving said workpiece transverse to the plane thereof, a cutting member secured to a carrier, and motive means for moving said carrier, said carrier being pivotally secured about a first fulcrum to said stirrup and about a second fulcrum to said motive means to be carried to move within a plane parallel to that of said stirrup in an arc having said cutting element intersecting a corner of said opening to cut the edge of said workpiece with a curved face.

2. The tool according to claim **1** wherein said stirrup comprises a pair of spaced plates secured to said head and said means for interconnecting said motive means and said cutting member comprises an arm connected to said motive means and depending between said plates, said carrier being pivotally journalled about a pin fixed to said plates and a pin fixed to said depending arm to be fulcrumed for arcuate movement about an axis remote from both said pins.

3. The tool according to claim **2** wherein said cutting member includes a blade, and fastening means for removably securing said blade to said body whereby the same may be removed and replaced.

4. The tool according to claim **3,** said cutting tool comprises a blade having a plurality of cutting edges and said means for securing said blade is adapted to locate the blade with any one of said edges exposed.

5. The tool according to claim **2,** said cutting member comprises a generally triangular body journaled adjacent the respective base angles thereof to said plates, said cutting blade being mounted on said body adjacent the third angle thereof.

6. The tool according to claim **2** wherein said motive means comprises a motor having a rotating drive shaft, an eccentric sleeve mounted on said drive shaft, said depending arm being journaled on said eccentric sleeve to move in a non-linear manner effecting the arcuate movement of the cutting member.

7. The tool according to claim **2** including bed plate means for supporting said workpiece and means for removably mounting said bed plate in the opening of said stirrup.

8. The tool according to claim **7** including means for movably mounting said bed plate within said opening to selectively adjust the position of said workpiece within said opening.

9. The tool according to claim **2** including guide means slidably mounted on said stirrup above said opening and movable into and out of the opening for said workpiece to limit the upper extent of said opening and to position said workpiece therein.

10. The tool according to claim **9** wherein said guide means comprises a triangular plate slidably mounted along one edge between the plates of said stirrup, the remaining edges of said guide extending at different angles with respect to said one edge, said guide being adapted to selectively present one of the remaining edges toward said opening thereby varying the angle of the edge limiting the upper extent of said opening.

11. The tool according to claim **9,** wherein said guide means and said cutting member are aligned in the same plane between the plates of said stirrup and cooperate to stabilize the workpiece during cutting.

12. The tool according to claim **2** wherein said plates are removably secured to said head, and said arm carrying said cutting member is removably secured to said cutting member, the means for securing said plates and head being removable and symmetrically arranged whereby the plates may be jointly reversed, reversing the position of said opening with respect to said head, and said arm reconnected to said cutting member.

13. The tool according to claim **8** wherein said bed plate comprises a body, a stem supporting said body, stem flange means supported by said stem, a groove formed parallel to the lower edge of the opening in each of said plates for receiving said flange means and screw means for connecting said body and stem in pressure engagement about the edge of said plates, said pressure engagement being releasable to permit sliding movement of said bed plate relative to the edge of said opening.

14. The tool according to claim **13** including second flange means supported by said stem and adapted to rest upon the edge of the opening, said screw means being adapted to raise said bed plate while maintaining said flanges in pressure engagement about the edge of the opening.

15. The tool according to claim **8** wherein the bed plate comprises a body and a stem having a pair of parallel opposed flat sides extending the length thereof integral with said body and includes a bushing secured between the plates of said stirrup, said bushing having a circular bore formed therein, and a screw extending radially therein, into selective engagement with the flat sides of said stem.

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